

ENOH 0695-030 COURSE SYLLABUS (Updated 9/13/2021) FALL 2021

(Note: This PDF file is provided to download and print for your convenience, when you need to access the course syllabus offline: please always check the Canvas course site for the most up-to-date version of the syllabus)

Course Title: Environmental Exposure Measurement and Assessment

Course Number: ENOH 0695-030

Course Pre- and Co-requisite(s): General Statistics

Course Location: EOHSI Conference Room C

Course Date & Time: Monday 6:00 PM – 8:00 PM

Course Instructors: *Panagiotis (Panos) G. Georgopoulos, Ph.D.*
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Environmental and Occupational Health Sciences Institute, Room 308
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Rutgers School of Public Health
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Guest Lecturers: Drs. Kathy Black, Stella Tsai

Office Hours: By appointment

Course Website: canvas.rutgers.edu

Required Course Text: None.

Readings/Resources: Reading materials will be distributed through Canvas.

Course Description: This course is a required course for MPH and PhD students in the Environmental and Occupational Health Program of Rutgers School of Public Health and for doctoral students in the Exposure Science Graduate Program, an option within the Department of Environmental Science of Rutgers. This course provides students basic scientific knowledge of sources of exposure, exposure measurement and assessment, and prevention and mitigation of hazardous environmental exposure. Topics include basic concepts of exposure science, the specific types and sources of environmental agents that people are exposed to, specific exposure measurement, assessment and modeling methods, and emerging environmental exposure issues. Skills will also be developed for designing exposure studies applicable to epidemiological investigations and health risk assessment.

Course Competencies:

Each Department identifies competencies for each degree offered. The competencies addressed in this course for the **PhD in Environmental and Occupational Health** include:

1. Design a testable hypothesis and execute research activity to investigate the effects of a toxicant, or toxin, or hazard event in a community;
2. Explain the importance of differences of susceptibility and vulnerability to environmental toxicant/toxins based upon age, gender, race, ethnicity, genetics and socioeconomic status in different populations;
3. Provide an informed expert opinion to government and/or community leaders regarding the extent or level of risk associated with a particular environmental or occupational hazard or condition;
4. Explain basic principles in environmental and occupational health sciences including toxicology, quantitative exposure assessment, epidemiology, and exposure science; and
5. Develop and/or apply novel and cutting-edge research methods in the laboratory and/or in the field.

The competencies addressed in this course for the **MPH in Environmental Health Sciences** include:

1. Describe the major environmental health problems facing the general public as well as among specific communities or susceptible, vulnerable sub-populations
2. Develop a testable model of environmental exposures (one or more agents) and adverse health outcomes (causing injury, disability, other measure of morbidity or mortality)
3. Specify current environmental risk assessment approaches and methods for a particular hazard or risk in a community.

The competencies addressed in this course for the **MPH in Occupational Safety and Health** include:

1. Identify occupational safety and health issues in the workplace and as applicable the related exposure risks to the general public as well as to vulnerable communities or susceptible sub-populations
2. Apply federal and state regulatory standards which are related to worker (occupational) safety and health protection
3. Develop testable models to validate occupational exposures (one or more agents) and adverse health outcomes (causing injury, disability, or other morbidity or mortality)

Please visit the Department webpages on the School of Public Health's website at <http://sph.rutgers.edu/> for additional competencies addressed by this course for other degrees and departments.

Course Objectives: By the completion of this course, students will be able to:

- a. Understand the basic concepts of exposure science.
- b. Understand principles and methodologies of exposure analysis.
- c. Develop effective exposure assessment strategies for human health studies and human health risk assessment.
- d. Be aware of the modeling tools for quantifying exposures.
- e. Be able to select or use proper techniques to measure or estimate human exposures.

PhD in Environmental and Occupational Health			
Competency	Course Objectives(s)	Lessons	Assessment(s)
1	a, b, c, d, e	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Class Discussion, Homework, Quizzes, Final Paper
2	a, b, c, d, e	1, 2, 3, 4, 6, 10, 14	Class Discussion, Homework, Quizzes, Final Paper
3	a, b, e	1, 2, 3, 4, 10, 11, 14	Class Discussion, Homework, Quizzes, Final Paper
4	a, b, d, e	1, 2, 3, 4, 5, 6, 8, 12, 13, 14	Class Discussion, Homework, Quizzes, Final Paper
5	a, b, c, d, e	1, 2, 9, 11, 12, 13, 14	Class Discussion, Final Paper
MPH in Environmental Health Sciences			
Competency	Course Objectives(s)	Lessons	Assessment(s)
1	a, b, c	1, 2, 3, 4, 7, 8, 11, 12, 13, 14	Class Discussion, Homework, Quizzes, Final Paper
2	a, b, c, d, e	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Class Discussion, Homework, Quizzes, Final Paper
3	a, b, c, d, e	1, 2, 3, 4, 13, 14	Class Discussion, Homework, Quizzes, Final Paper
MPH in Occupational Safety and Health			
Competency	Course Objectives(s)	Lessons	Assessment(s)
1	a, b	1, 2, 4, 5, 7, 8, 9, 10, 11, 14	Class Discussion, Homework, Quizzes, Final Paper
2	a, d, e	1, 4, , 5, 8, 10, 14	Class Discussion, Homework, Quizzes, Final Paper
3	a, b, c, d, e	1, 2, 7, 8, 9, 14	Class Discussion, Homework, Quizzes, Final Paper

Course Requirements and Grading:

- Activities, assignments, projects, exams, etc. that contribute to course grade, and the respective point/percentage value of each

Class Participation	10 points
Homework/Discussion	30 points (Late -1 point/day)
Quizzes	25 points
Final Paper/Presentation	35 points (Late -5 points/day)

Class participation will be based on presence and on interactions during the weekly lecture .

The **homework/discussion** will be based on a question or statement proposed to which a response (suggested to be between approximately 200 and 400 words) should be provided. After you submit your entry you will then see the full discussion thread. It is expected that you will respond to one or more of the other students' entries. At the beginning of the lecture following the discussion thread there will be a concluding portion of the discussion for up to 10-15 minutes. Your discussion should be based predominantly on scientific journal articles when possible, including the citation of the source of the materials presented. The discussion is due to be posted by Saturday at midnight following the Monday lecture it is based on.

Quizzes (5 over the semester) – will typically be 30 - 45 minutes each. They will be "take-home" online quizzes that you will take at a time convenient to you, usually within a 5-7 day period; however, once you start the quiz you have to complete it within the allotted time (so when you begin the quiz do not stop working it until you are finished).

The **final paper/essay** will consist of a summary and discussion of a recently published peer-reviewed journal article that will be selected by the student. ***The topic (i.e. the published journal article) must be submitted by November 15 and approved by November 20, 2021. A brief recorded slide presentation summarizing the content of the essay must be submitted by December 13 and the full essay will be due on December 16,*** A question and answer session for all presentations will take place during the last class day, Monday December 20, 6-8 pm. Detailed information about the topic selection and the structure, content and submission of the final presentation and paper/essay will be provided in the Assignments section of the course Canvas site.

GRADING SCALE

A (94 - 100)

A- (90 - < 94)

B+ (87 - < 90)

B (84 - < 87)

B- (80 - < 84)

C+ (77 - < 80)

C (70 - < 77)

F (<70)

COURSE SCHEDULE (Fall 2021):

(Note: Please always check the Canvas course site for modifications and updates)

Date (2021)	Lecture/Topic	Instructor
September 13	<p>01. Course Introduction and Basic Concepts</p> <ul style="list-style-type: none"> • Source-to-health conceptual paradigm • Definition of exposure • Exposure routes • Exposure pathways • Exposure as a bridge science <p><i>Reading Material:</i> (Please note that full reports/books for any chapters or sections listed as reading material in all lectures are available in the Exposure Course Resources page; in some cases, where reading material points/links to journal articles, a login through Rutgers Libraries, using your netid, may be required)</p> <p>- Chapter 2 in: USEPA (2019) Guidelines for Human Exposure - Pages 15-23 in: OSHA (2016) Recommended Practices for Safety and Health Programs</p> <p><i>Supplementary Reading:</i> - Vermeulen R., et al. The exposome and health: Where chemistry meets biology. Science 367 (6476) 392-396, 2020 - Chapter 1 in: National Research Council (2012) Exposure Science in the 20th Century - Lioy, Exposure Science: A View of the Past and Milestones for the Future. Environmental Health Perspectives 118(8) 1081-1090, 2010</p>	Georgopoulos
September 20	<p>02. Exposure Metrics and Factors</p> <ul style="list-style-type: none"> • Classifications and Metrics of exposure • Exposure factors • Exposure factors handbook and other resources <p><i>Reading Material:</i> - Chapter 5 in: USEPA (2019) Guidelines for Human Exposure - Chapter 1 in: USEPA (2011) Exposure Factors Handbook (Full reports available in Exposure Course Resources)</p>	Georgopoulos
September 27	<p>03. Geographic Information Systems (GIS) for Exposure and Public Health</p> <ul style="list-style-type: none"> • Basic concepts and Tools of GIS • Applications of GIS in Exposure and Public Health • Geospatial Methods – Strengths and Limitations <p><i>Reading Material:</i> - Chapter 5, Geospatial Data for Environmental Health, in: Frumkin, ed. (2016) Environmental Health: From Global to Local, Third Edition (The full book is available online through Rutgers Libraries; a link for accessing the book is provided on the Exposure Course Resources page)</p>	Georgopoulos

Date (2021)	Lecture/Topic	Instructor
October 4	<p>04. Designs for Human Exposure Assessment Studies</p> <ul style="list-style-type: none"> • What is an environmental exposure study? • Exposure determinants • Distributions of exposure • Study design • Ethical issues in exposure studies <p><i>Reading Material:</i> - Understanding different sampling methods - Strata Lecture notes on Distributions - Uncertainty and variability</p> <p><i>Supplemental reading:</i> - Bornstein et al Sampling in development science: Situations, shortcomings, solutions, and standards, Developmental Review 33(4) 357-370, 2013</p>	Weisel
October 11	<p>05. Inhalation Exposure Assessment</p> <ul style="list-style-type: none"> • Major pollutants of concern • Microenvironments • Exposure components • Inhalation exposure estimates <p><i>Reading Material:</i> - Weisel 2019 Exposure Science: Routes of Exposure – Inhalation (for class use only, do not distribute). - USEPA Exposure Assessment Tools by Routes – Inhalation (Multiple Pages) - Occupational Hygiene – Occupational Exposure Limits (Canada OSHA)</p>	Weisel
October 18	<p>06. Microbial Exposure Assessment</p> <ul style="list-style-type: none"> • Microbial exposure concepts • Mechanisms and pathways for microbial exposure • Exposure measurement methods <p><i>Reading Material: TBA</i></p>	Tsai
October 25	<p>07. Dermal and Multimedia Exposure Assessment</p> <ul style="list-style-type: none"> • Dermal exposure and dose • Mechanisms and pathways for dermal exposure • Exposure measurement methods <p><i>Reading Material:</i> - Behrozy 2013 On Dermal Exposure Assessment International Journal of Occupation and Environmental Medicine 4(3),113-127. - USEPA Exposure Assessment Tools by Routes - Dermal (Multiple Web Pages) - OSHA Section II Chapter 2 Surface, Contaminants, Skin Exposure, Biological Monitoring and Other Analyses (Parts I, II, III and IV)</p> <p><i>Supplemental Reading:</i> - Dermal Exposure Assessment: A Summary of EPA Approaches EPA/600/R-07/040F 2007 - More comprehensive document can be downloaded here</p>	Weisel

Date (2021)	Lecture/Topic	Instructor
November 1	<p>08. Ingestion Exposure Assessment</p> <ul style="list-style-type: none"> • Sources of exposures and contaminants • Dietary Ingestion • Non-Dietary Ingestion • Exposure measurement methods <p><i>Reading Material:</i> - USEPA Exposure Assessment Tools by Route - Ingestion (Multiple Web Pages) - National Center for Healthy Housing - Lead (web page) - Cherrie et al How Important is Inadvertent Ingestion of Hazardous Substances at Work? Ann Occup Hyg 50(7) 693-702, 2006 (available online through Rutgers Libraries - netid and password required for access) <i>Supplemental Reading:</i> - Lioy, Freeman, Millette Dust: A Metric for Use in Residential and Building Exposure Assessment and Source Characterization, Environmental Health Perspectives 110 (10) 969, 2002</p>	Weisel
November 8	<p>09. Biomonitoring of Exposure</p> <ul style="list-style-type: none"> • Biomarkers • Biomarker development and measurement • National biomonitoring program • Application of biomarkers in exposure assessment <p><i>Reading Material:</i> - NRC Committee on Biological Markers, Biological Markers in Environmental Health, EHP 74. 3-9, 1987 - Details for Environmental Exposures: Chapter 4 in: National Research Council (2006) Human Biomonitoring of Environmental Chemicals (Full report available in Exposure Course Resources) - Details for Occupational Exposures: OSHA-CDC Application of Biological Monitoring Methods for Chemical Exposures in Occupational Health</p>	Weisel
November 15	<p>10. Nonchemical Stressors and Indoor Air Chemistry</p> <ul style="list-style-type: none"> • Radiation • Noise • Thermal • Indoor air and indoor air chemistry <p><i>Reading Material: TBA</i></p>	Weisel
November 22	<p>11. Modeling and Simulation of Exposure I - External Exposures</p> <ul style="list-style-type: none"> • Overview of external exposure modeling • Rationale and applications of external exposure modeling • Types of environmental and exposure models <p><i>Reading Material:</i> - Chapters 5, 6 and 8 in: USEPA (2019) Guidelines for Human Exposure (Full report available in Exposure Course Resources)</p>	Georgopoulos

Date (2021)	Lecture/Topic	Instructor
November 29	<p>12. Modeling and Simulation of Exposure II - Internal Exposures</p> <ul style="list-style-type: none"> • Overview of biokinetic modeling • Rationale and applications of biokinetic exposure modeling • Types of internal exposure and dose models <p><i>Reading Material:</i> - Chapters 5, 6 and 8 in: USEPA (2019) Guidelines for Human Exposure (Full report available in Exposure Course Resources) - Chapter 10, Physiologically Based Pharmacokinetic Modeling in: Nieuwenhuijsen, ed. (Oxford 2003) Exposure Assessment in Occupational and Environmental Epidemiology (The book is available online through RU Libraries)</p>	Georgopoulos
December 6	<p>13. Time-Activity-Location Survey Methods for Exposure Assessment</p> <ul style="list-style-type: none"> • Overview • Questionnaire design • Questionnaire administration • Global Position System • Data analysis <p><i>Reading Material:</i> - Freeman & de Tejada, Methods for collecting time/activity pattern information related to exposure to combustion products. Chemosphere, 979-992, 2002 (available online through Rutgers Libraries - netid and password required for access)</p>	Black
December 13	<p>14. Exposure Analysis for Risk Assessment</p> <ul style="list-style-type: none"> • Risk assessment concepts and tools • Exposure metrics for different risk questions • Tiered risk assessment • Uncertainty and variability in exposure and risk assessments • Exposure errors and their impacts on risk assessment <p><i>Reading Material:</i> - Chapters 1, 2 and 3 in USEPA (2007) Concepts, Methods, and Data Sources For Cumulative Health Risk Assessment of Multiple Chemicals, Exposures and Effects (Full report available in Exposure Course Resources)</p>	Georgopoulos
December 13	Term Project Presentation is Due	
December 16	Term Project Essay is Due	
December 20	15. Question & Answer Session for Term Project Presentations	Georgopoulos/ Weisel

Learning Management System: Canvas will be used extensively throughout the semester for course syllabus, assignments, announcements, communication and/or other course-related activities. It is the student's responsibility to familiarize themselves with Canvas and check it regularly. If you have difficulties accessing Canvas, please inform the instructor and Canvas Support (help@canvas.rutgers.edu). Canvas is accessible at canvas.rutgers.edu.

School of Public Health Honor Code: The School of Public Health Honor Code is found in the student bulletin (sph.rutgers.edu/academics/catalog/index.html). Each student bears a fundamental responsibility for maintaining academic integrity and intellectual honesty in his or her graduate work. For example, all students are expected to observe the generally accepted principles of scholarly work, to submit their own rather than another's work, to refrain from falsifying data, and to refrain from receiving and/or giving aid on examinations or other assigned work requiring independent effort. In submitting written material, the writer takes full responsibility for the work as a whole and implies that, except as properly noted by use of quotation marks, footnotes, etc., both the ideas and the works used are his or her own. In addition to maintaining personal academic integrity, each student is expected to contribute to the academic integrity of the school community by not facilitating inappropriate use of her/his own work by others and by reporting acts of academic dishonesty by others to an appropriate school authority. It should be clearly understood that plagiarism, cheating, or other forms of academic dishonesty will not be tolerated and can lead to sanctions up to and including separation from the Rutgers School of Public Health.

Policy Concerning Use of Recording Devices and Other Electronic Communications Systems: When personally owned communication/recording devices are used by students to record lectures and/or classroom lessons, such use must be authorized by the faculty member or instructor who must give either oral or written permission prior to the start of the semester and identify restrictions, if any, on the use of mobile communications or recording devices.

Posting of Course Materials and Lectures or Slides on Web Sites: Distributing instructor-owned course materials without the permission of the instructor is not permitted and is a violation of academic policy and of U.S. Law. Unauthorized upload of instructor's and/or student created documents could violate the University Academic Integrity Policy and subject the student to disciplinary action. Such action may be considered copyright infringement and facilitate academic dishonesty.

Students with Disabilities: Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student must apply for Services by first completing a Registration Form with the Rutgers Office of Disability Services (ODS) at ods.rutgers.edu. The student will also be required to participate in an ODS intake interview and provide documentation. If reasonable accommodations are granted, ODS will provide you with a Letter of Accommodations which should be shared with your instructors as early in your courses as possible.

Commitment to Safe Learning Environment: The Rutgers School of Public Health is committed to helping create a safe learning environment for all students and for the School as a whole. Free expression in an academic community is essential to the mission of providing the highest caliber of education possible. The School encourages civil discourse, reasoned thought, sustained discussion, and constructive engagement. Provocative ideas respectfully presented are an expected result. An enlightened academic community, however, connects freedom with responsibility. The School encourages all students to disclose any situations where you may feel unsafe, discriminated against, or harassed. Harassment or discrimination of any kind will be not tolerated and violations may lead to disciplinary actions.

Reporting Discrimination or Harassment: If you experience any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, know that help and support are available. You may report such incidents to the [RBHS Title IX Office](#) or to the School of Public Health's [Office of Student Affairs](#). Rutgers University has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more. If you experience any other form of discrimination or harassment, including racial, ethnic, religious, political, or academic, please report any such incidents to the School's [Office of Student Affairs](#). The School strongly encourages all students to report any incidents of discrimination or harassment to the School. Please be aware that all Rutgers employees (other than those designated as confidential resources such as advocates, counselors, clergy and healthcare providers as listed in Appendix A to [Policy 10.3.12](#)) are required to report information about such discrimination and harassment to the School and potentially the University. For example, if you tell a faculty or staff member about a situation of sexual harassment or sexual violence, or other related misconduct, the faculty or staff member must share that information with the [RBHS Title IX Coordinator](#). If you wish to speak to a confidential employee who does not have this reporting responsibility, you can find a list of resources in Appendix A to University [Policy 10.3.12](#). For more information about your options at Rutgers, please visit [Rutgers Violence Prevention and Victim Assistance](#).

Graduate Student Computer Policy: Students are required to possess a personal laptop, no older than approximately two years, that must meet minimum requirements which may be found online at: sph.rutgers.edu/student-life/computer-support.html

Policy Concerning Use of Turnitin: Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com (directly or via learning management system, i.e. Canvas) for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site. Students who do not agree should contact the course instructor immediately.

Withdrawal/Refund Schedule: Students who stop attending their course(s) without submitting a completed [Add/Drop Course](#) form will receive a failing grade. Furthermore, students dropping to zero credits for the semester are considered withdrawn and must submit a completed [Leave of Absence](#) form from the School of Public Health's Office of Student Affairs. The School of Public Health refunds tuition only. Administrative and technology fees are non-refundable. You may find the Withdrawal/Refund Schedule on the School of Public Health website at: sph.rutgers.edu/academics/academic-calendar.html

Special Circumstances During COVID-19, For Fall 2021 (Version Date 8/20/21)

To keep our on-campus communities safe, compliance with all current guidance and policies as set forth in the [Guide to Returning to Rutgers](#) is required at all times and without exception. Students, faculty, staff, or visitors who do not comply with these policies will not be permitted to remain on-site. The use of face-coverings indoors *IS* required in classrooms and offices as well as shared spaces (such as hallways and bathrooms). Rutgers employees and students must use the [My Campus Pass](#) symptom checker, a self-screening application, each day when traveling to campus or entering a Rutgers building. Please remember to wash your hands, wear a mask while indoors, particularly in crowded spaces and groups, and stay up-to-date on university guidance by consulting the [Guide to Returning to Rutgers](#) and the university's [COVID-19 website](#).

In addition, the School of Public Health recognizes that students may experience challenges or be negatively impacted due to the COVID-19 pandemic, mental and emotional health toll from systemic racism, altered personal and professional obligations, and other crises existing at the moment in our local, national, and global communities. Students are encouraged to discuss these challenges and circumstances with their instructor, if they feel they may need additional support or temporary accommodations at the beginning or during this course. The course instructor may consider making reasonable temporary adjustments depending on the student's situation. If additional support is needed, students may reach out to the Office of Student Affairs (studentaffairs@sph.rutgers.edu) or any of the appropriate referral resources listed on the [SPH Student Connect](#) Canvas page.